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ABSTRACT

This paper discusses the critical events in the personal and professional lives of Finnish Olympians that have helped them to actualize their talent in science. The data include quantitative data from 158 Finnish Olympians in math, physics, and chemistry. The qualitative data include twelve in-depth interviews of these Olympians and their curricula vitas. Half of these interviews (N=6) are with female Olympians who have chosen science as their career. Every female was chosen to have a male Olympian from the data that represented the same age group and professional orientation of the female. The females and males are compared together in order to find possible similarities and differences in events they have experienced in their personal and professional lives. The common factor that has contributed to the talent development of both females and males include strong inner drive in learning. The results reveal that the males have made their professional choices earlier than females. Furthermore, the males reported having more encouragement from their families and friends to choose a career in science. The case studies reveal some interesting gender differences in the talent development of gifted people in science. The results can be used to inform teachers and parents of possible gender biases at homes and schools. The paper suggests some concrete ways to encourage females to enter and remain in professional careers in science. (Contains 35 references.) (Author/ASK)

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RUNNING HEAD: ACTUALIZING TALENT IN SCIENCE: CASE STUDIES OF FINNISH OLYMPIANS

ED 452 067

K. Tirri

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Actualizing talent in science: case studies of Finnish Olympians

A paper presented at the Annual Meeting of the American Educational Research Association in Seattle, Washington, April 2001.

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Abstract

This paper discusses the critical events in the personal and professional lives of Finnish Olympians that have helped them to actualize their talent in science. The data include quantitative data from 158 Finnish Olympians in math, physics and chemistry (Tirri 2000a). The qualitative data include twelve in-depth interviews of these Olympians and their curricula vitas. Half of these interviews (N=6) are with female Olympians who have chosen science as their career. Every female was chosen to have a male Olympian from the data that represented the same age group and professional orientation than the female. The females and males are compared together in order to find possible similarities and differences in the critical events they have experienced in their personal and professional lives. The common factor that has contributed to the talent development of both females and males include strong inner drive in learning. All the Olympians have enjoyed intellectual challenges and they have been very independent learners at school. The results reveal that the males have made their professional choices earlier than the females. Furthermore, the males reported having more encouragement from their families and friends to choose science as their career. The case studies reveal some interesting gender differences in the talent development of gifted people in science. The results can be used to inform teachers and parents of the possible gender biases at homes and schools. The paper suggests some concrete ways to encourage females to enter and remain in professional career in science.

Actualizing talent in science: case studies of Finnish Olympians

Women of science in Finland

Due to the history of women's rights, Finland offers a culturally interesting context in which to explore the status and the role of female scientists. Women in Finland have a long tradition in the labor force, and the percentage of working women (approximately 80%) is among the highest in the world. Finnish women enjoy an advanced status internationally, measured by indicators such as general suffrage (granted in 1906) and the composition of the parliament (38.5% female). Additionally, in the year 2000, the first female president of Finland was elected. Women's rights and equality issues are under constant public debate. The advanced gender relations can be seen, for example, in the fact that a father can take a paternity leave when a mother resumes her career. In academia, this kind of role reversal is becoming more common (Wager, 1994).

Given the advanced status of women in the Finnish society, we can assume that talented women in Finland are in control of their own lives, which contributes greatly to their talent and career development (Reis, 1998). Women in Finland gained equal rights to pursue academic studies in 1901, and in 1927 the first Finnish woman received a professorship. Today, Finland tops the OECD (Organization for Economic Co-operation and Development) statistics in the percentage of women earning academic degrees. However, women and men continue to study different subjects, and there has been little change in this respect over the past couple of decades. Examples of women's choices are veterinary medicine, health care, pharmacology and educational sciences, in which more than 80% of the new students in 1995 were women. The technical subjects are, by contrast, clearly male dominated, with more than 80% of the students being men (Women in Academia, 1999). The proportion of women earning a doctorate in Finland was 40.1% in 1996. However, the gender bias can be seen in

the disciplines chosen by women. In 1995, the proportion of women obtaining a doctorate was highest in medicine and the nursing sciences (53%) and lowest in technology (11%). The same gender bias concerning the disciplines has been reported for American women, as well. American studies reveal that scientifically competent women are especially interested in biology, chemistry, medicine, and health, rather than physics, computer science, and engineering. Helping others and doing something worthwhile for society serve as powerful motivators to attract gifted women to science in general, and to the biosciences and health in particular (Rosser, 2000).

When gifted women enter academia, they soon realize that the research faculty in Finnish universities is still clearly differentiated according to education and sex. The more teaching an appointment involves, the more likely the post is to be occupied by a woman, whereas the highest university appointments are clearly male dominated. Today in Finland, the percentage of women professors is still very low (17%). Both the under-representation of women in university research communities as well as male-led hierarchies are global phenomena. One special feature in all of the Nordic countries regarding the female role is that more academic women tend to be married and have children than, for example, in the United States (Women in Academia, 1999).

Based on previous American studies (e.g., Kerr, 1994; Reis, 1998), the effect of society on female talent development is evident. Society in many cases creates confusion, a state of mixed messages, which can lead to conflict between a female's own abilities and the social structure of her world (Bizarri, 1998; Reis, 1998). Many women face socio-cultural expectations that limit their ability to seek help (Bizarri, 1998). Conflicts can turn into social obstacles, which could have both negative and positive effects.

In this paper, we explore the role of critical events in the lives of gifted Finnish Olympians. The purpose of the study is to identify those events that have helped them to

succeed in their professional and personal lives. Our goal is to compare the critical events of females and males together in order to identify some gender related patterns in their life histories. The results of our study are compared to other studies of gifted females (e.g., Bizarri, 1998; Kerr, 1994; Kitano, 1997; Leroux, 1998; Reis, 1998), and the effects of culture and society are discussed as important influences in their talent development.

Researching gifted women in science

The role of females in academia and science has been under intensive investigation in recent years. Researchers have studied the obstacles (Bizarri, 1998; Leroux, 1998; Kerr, 1994; Reis, 1998), psychological characteristics (Holahan, 1984; Noble, Subotnik, & Arnold, 1999; Rogers, 1991), and environmental effects (Kitano, 1997; Tirri, 2000a), comparing women to each other and to men. In this literature review, our purpose is to highlight some research especially relevant to women's own choices, compromises and beliefs in their scientific giftedness and achievements in life.

Evidently, many problems related to the position of female scientists still exist. Various obstacles gifted females in academia face are related to cultural attitudes and women's role. Kerr (1994) and Reis (1998) identified external barriers to gifted women as including the attitudes of parents and school, environmental opinions and possible discrimination or harassment at school or at work. The possible internal barriers among gifted females included self-doubt, self-criticism, and too low expectations. Those psychological barriers were identified through various phenomena as the "Cinderella complex" (there will always be a man to take care of a woman), the "Horner effect" (women underachieving when competing with men), or the "Imposter phenomenon" (girls contribute their success to external forces--for example to luck). According to Siegle and Reis (1998), gifted girls tend to underestimate their abilities, especially in mathematics, social studies, and science. Research results have also shown a positive correlation between perceived ability and achievement

(Multon, Brown, & Lent, 1991). Therefore, women's self-perception of their own abilities becomes a key factor in keeping gifted girls involved in higher-level mathematics and science courses.

Quite clearly, not all women scientists can be successful in balancing their lives, as Arnold (1995) has noted in her study of high school valedictorians in the class of 1981 when dividing her data into career- oriented and non-career oriented women. Kerr (1994) stated how leadership, maturity, age at first marriage and number of children contributed to female success whereas men's success was more related to job experience. According to current research on gifted females, the secrets of those women who have been successful include choices and compromises related to their work and personal lives. Many talented young women lower their aspirations and choose less demanding careers that they believe will enable them to marry. Women gifted in math and science continue not to pursue careers in these fields (Rosser, 2000). Instead, they may select a more traditional career such as teaching or nursing. Those women who choose a career in science rarely produce as much creative work in the form of research publications as do their male colleagues (Ajzenberg-Selove, 1994; Piirto, 1991). The most successful and productive women are shown to display contextual intelligence (Sternberg, 1986) that helps them to adapt or change their environment in order for their talents to be realized and developed (Reis, 1998, 16). Personality traits of successful female scientists include determination, motivation and willingness to take risks and attempt tasks that others did not have the courage to pursue. According to Reis, all the gifted women whom she had studied had had lives that include complex decisions, compromises, conflicts, and contradictions (Reis, 1998, 20-21). The compromises of a creative productive life might include the reality of few friendships and negative environmental attitudes. However, many gifted females find happiness by combining family life with meaningful work. According to research on gifted women and marriage, it is

possible to have both. A relationship in which women will not have to choose between emotional intimacy and professional achievement, but in which the two are intertwined, is shown to be the best choice for high-achieving females (Hansen & Hall, 1997).

Gifted women define success by different criteria than do gifted males. According to longitudinal studies, gifted females report personal and relational areas of achievement among their greatest attainments (Hollinger & Fleming, 1992, 209). Furthermore, many women speak of achievement in terms of feelings of peace, happiness, and creativity with relation to both their work and family life (Harris, 1992). Gifted men, instead, tend to refer to work-related accomplishments as their greatest achievements (White, 1990).

Choices and compromises of gifted females add to the research tradition exploring critical events in the lives of successful people. In the field of gifted education, for example, researchers Kerr (1994) and Kitano (1997) have utilized critical events as part of their data analysis. Kerr (1994) compared critical events to crucial moments. She stated how major occupational or professional changes were usually in response to a family situation. Kitano (1997) has utilized in her study participant women's interpretations of events in their lives, but systematic analysis of those events is missing. Reis (1998) has used similar sections of choices and compromises in the lives of gifted females in her book *Work Left Undone*. Tirri and Koro-Ljungberg (2001) have studied the critical incidents in the lives of gifted female Finnish scientists. Their study revealed gender-related choices and compromises that female scientists of different fields and ages need to do to balance their lives.

Data and the methods of the study

Description of the data

The data of this study was based on interviews with Finnish mathematical Olympians. The interviews with Olympians lasted one to two hours each, and all of the material from the interviews was transcribed. Additionally, curriculum vitae were collected and field notes taken to support the interpretation of their life stories. The whole sample of Olympians included 158 gifted young people who participated in the mathematical Olympics during the years 1965-1997. Only eight of them were females. The quantitative description of the study can be found in Tirri (2000a). The data for this paper includes in-depth interviews of those female Olympians who agreed to be interviewed. Every female was chosen to have a male Olympian from the data that represented the same age group and professional orientation than the female. This selection makes it possible to find possible similarities and differences in the critical events they had experienced in their personal and professional lives.

As Table 1 demonstrates, our qualitative sample includes six male and six female Olympians of different ages and fields of science. All the males have chosen mathematics or computer science as their major. The females' fields include mathematics, physics and medicine. Jari is the only male of these six who doesn't have a Ph.D. Two of the males are single, one is divorced with children and three are married or engaged in the permanent relationship with children. The three youngest female Olympians are in their thirties and single. Only one of them (Elina) has chosen a career in the academic world with publication activity. The oldest female Olympians are all married and two of them (Hanna and Kaisa) are well-known researchers with publication production.

As Table 1 demonstrates, the male Olympians in Academia publish more than their female colleagues. Patric and Matti have both almost sixty publications in refereed

journals and conference proceedings. The oldest female Olympian Kaisa, who is a well-known researcher in her field, has approximately thirty publications. Additionally, she is the only female with patents. Two of the males (Patric and Heikki) have patents in their list of academic productivity. Two of the male Olympians (Patric and Timo) are currently professors in their fields. None of the females are professors in their fields; the most successful female Olympians carry the title researcher in their curriculum vitae.

(INSERT TABLE 1 HERE)

Most of the Olympians came from families of two or more children. The majority of participants were firstborn children in their families. The socioeconomic status and the education of their parents varied. On the whole, the Olympians had positive school experiences, and the greater part of them had been excellent students. Furthermore, they all emphasized the role of hard work in achieving good grades in school.

Methods

The researcher interviewed the Olympians by herself. In the personal interviews, the professional and personal lives of Olympians were discussed. The themes discussed in the interviews included childhood experiences, school experiences, the choice of career, job, spouse, life-style, friends and hobbies. A special emphasis was placed on the critical events identified by Olympians. Critical events in this study were defined as experiences that helped the Olympians to identify their talent or to succeed in their career.

In previous educational research, critical events have been used as a tool of qualitative data analysis. John Flanagan (1953) was among of first researchers to describe the critical incident technique. He stated how the critical incident technique became essential when collecting certain important facts related to defined situations. Later, Tripp (1994), for example, studied teachers' life histories through the critical incident method, where critical incidents produced "an ongoing and discontinuous account of fragments of the past" (p.65).

Coffey and Atkinson (1996) referred to stories marked by key happenings, Kerr (1994) analyzed crucial moments, and Miles and Huberman (1994, p.115) used the critical incident chart to list "those events seen as critical, influential, or decisive in the course of some process." Richardson (1995) postulated that people make sense of their lives in the terms of special events, critical events. She went even further and claimed that connection between critical events constituted the meaning of narrative, whereas Denzin (1989) explained how lives are constructed and turned around by significant events.

In each interview of this study, the Olympians identified most of the critical events by themselves. In a few interviews, the Olympians did not directly mention some of the events as critical in their life. However, these events were identified as critical by the researcher during the data analysis. These kinds of events include early experiences in reading and mathematics that the interviews told the researcher during the interviews.

Data analysis

A content analysis was used to analyze the themes of critical events in the lives of the Olympians. In each interview, all the events were counted and labeled (see Table 2). The female data was analyzed first and the coding categories were established based on the critical events in their lives. Secondly, the male data was analyzed using the same coding categories. Most of the categories suited this data set, as well. However, one new sub-category had to be added. After establishment of final coding categories, the reliability of coding categories was tested. The interrater reliability was .90, based on the independent scoring of 11 interviews by two raters and an index calculated by the formula (number of rater agreement)/(number of life stories).

Critical events in the lives of Finnish Olympians

Events in childhood

According to our analysis, the male Olympians identified more important events in their childhood that have influenced their talent development than the females did (see Table 2). All the males mentioned early reading experiences as critical events that have helped them in actualizing their talents. Elina was the other female who identified early reading experience as influential for her talent development. She learned to read at the age of four. The following quote from her interview demonstrates a typical reading experience by Finnish Olympians: "I had a big brother and I followed his interests. I remember I read all his books. I can remember an event in the kitchen. I was playing with a milk carton when I noticed the word "milk" was written on it. I identified the letters and matched them together to form the word. I remember, how I felt the letters and sounds in my mouth and it was wonderful!"

The males reported early experiences related to mathematics as being critical, as well. Timo, a professor in mathematics, described his early experience related to mathematics in the following way: "I can remember an event in my very early childhood. I was only two years old, and I understood the number two. We lived in Helsinki in an apartment building and I had a girlfriend who lived on the second floor. Once I passed her door and I thought that now I am two years old and she lives on the second floor. When I turn three she will live on the third floor." The females reported less early childhood experiences related to reading and mathematics. However, most of them were early readers and some of them had equal experiences to men. The experiences reported by females were more associated with school. Riitta remembered a critical event in her childhood related to mathematics that influenced her to choose mathematics as her field. She described this event in the following way: "I was on

the way to school and I solved a math problem I had found very difficult. I had wondered what 15 +15 was. During that trip I realized how to solve that problem. I was very proud of myself. I can still remember the feeling."

The males reported more events related to science experiments and discussions with their parents than the females did (see Table 2). Many times parents had encouraged their sons to explore the nature and discussed scientific phenomena with them. The parents of females had emphasized music and play more than scientific issues with their daughters. Only two females remembered any events related to science or discussions with their parents as critical for their talent development.

(INSERT TABLE 2 HERE)

Events in school

All the Olympians had enjoyed academic competitions during their school years. A young physicist describes her beliefs and values associated with challenge and competition in the following way: " I need to know how things work and I want to be challenged in my life. All the competitions have been very important for me. I want to test my knowledge and show to myself and to others what I can master in my field. I simple want to be the best." A competitive mind has been identified as a typical feature of gifted Finnish female scientists (Tirri & Koro-Ljungberg, 2001). The males seemed to enjoy the competitions even more than the females. None of the females had participated in the Olympics more than once. Two of the males, Heikki and Jari, had taken part in the Olympics in mathematics and physics three or four times. In the interviews all the Olympians emphasized the importance of the Olympiad experience for their identity and talent development. Like Heikki mentioned: "The success in the competitions made me realize that I am really gifted, and the competitions have helped me

to learn to trust myself in my academic studies as well. I had the self-confidence that was needed in order to succeed in doctoral studies."

Both males and females reported events related to teacher encouragement as critical in their talent development. However, teachers' feedback had been even more influential to the females than the males (see Table 2). Hanna described the influence of teachers in her talent development in the following way: "I had wonderful female teachers in mathematics and chemistry. In physics I had a bad male teacher but he was very nice. He was the type who wanted to be a researcher but ended up teaching. He was such a lousy teacher, but so nice and encouraging and warm. I studied everything by myself from the books; he couldn't help me academically. However, I liked the teacher and that made me study even more."

Males reported more peer support during their school years. Evidently it was easier for the boys than for the girls to find friends who had the same interests in science and math. The peer support influenced their choices for college, as well. Most of the male Olympians had chosen the same fields of science as their peers. Furthermore, they had been encouraged to choose those fields by their teachers and parents. The females reported loneliness and lack of social contacts as being the most problematic experiences in school. Most of the females found peers with same interests in the upper secondary school. The females reported fewer hobbies that have been helpful for their talent development than the males. Typical male hobbies included computers and chess. The females enjoyed reading alone and other hobbies more than science, during their leisure time.

Events in college

College time had a great influence on the females' career choices. Those females (Hanna and Elina) that had a good mentor continued their studies at the graduate level. The Finnish Olympians reported less mentoring than their American counterparts as influential

events on their career development (Campbell, 1996). Only two females and one male mentioned their mentors as critical persons in their career development. A typical Finnish Olympian reported independent study and inner drive to be the most important things in their talent development, (Tirri 2000b). Furthermore, they emphasized the right choice with the domain and studies abroad as more influential events for their career development (see Table 2).

The majority of them were happy with their career choices. These Olympians have had the personal talent (Moon, 2000) or intra personal intelligence (Gardner, 1993) to understand their own motives, inner drives and interests when identifying the right domain in their own field of science. The most successful researchers in both groups studied were those Olympians who had been able to choose the right domain, -- for example, mathematics or computer science -- and had become internationally known researchers in that domain. A typical answer to the question of why the Olympians chose mathematics and science as their domain is expressed in the quote by Sirpa: "I have enjoyed my domain because it involves studies in mathematics and science. It has been easy for me to advance in my work because I chose a domain that allows me to enjoy the beauty and logic of math and science."

Five Olympians out of twelve mention studies abroad as a critical event in their lives (see Table 2). These Olympians were the most well known researchers with the widest publication activity of all the Olympians. According to our study, studies abroad have a crucial impact on the career development of Finnish scientists. Additionally, years spent abroad at various universities brought some of the Olympians to a deeper understanding of the opportunities and challenges in scientific work. As Olympian Hanna emphasized: "A researcher in the natural sciences has to work in different places and learn how to do research at the top."

Events in adulthood

Two of the females and three of the males mentioned the choice of a partner as an important choice affecting their success (see Table 2). The male professor in mathematics admitted that: "My wife takes care of our three kids and runs the household so that I can concentrate on my research. I love the esthetics of mathematics and it takes time to create a masterpiece. I have the circumstances that allow me to work the way I want." The females emphasized the co-operative and equal husband as a critical asset in their lives. Like Hanna reported: "We are both researchers and we share the responsibilities at home. Both of us have the opportunity to work and take care of our home. My husband has always been very supportive because he understands the demands of this kind of work."

Two female Olympians and three males had utilized co-operation with foreign colleagues to keep up with worldwide progress in their domain, which has been reported as being significant in promoting one's career (Sawyer & Csikszentmihalyi, 1994). The most well known researcher of all Olympians, Patric, has worked with more than twenty colleagues from ten different countries in his international publications. Evidently, international co-operation opens doors to important publications and makes Finnish science known to the international research community. Two of the male Olympians had continued their Olympics experiences by mentoring the future Olympians. Both these men give their leisure time to train and mentor young talented youth in mathematics. Matti acts as a leader of the Finnish math team and Jari helps him to train the future Olympians.

Concluding discussion

Our study reveals critical events that have helped the Finnish Olympians in actualizing their mathematical talents. The males had more critical events in their childhood than the females. Male Olympians identified early reading and mathematics experiences as more influential than the females did. Furthermore, the males had had more science

experiments and discussions with their parents than the females had. According to previous research on gifted children, more boys than girls have been encouraged by their parents to pursue a specific career (Reis, 1998). In early childhood, child's reading, mathematics and science experiments are greatly dependent on parent's readiness to provide books and other materials for their child. The case studies of Finnish Olympians reveal that the males had been provided more early encouragement in math and sciences than the females had.

During the school years, both male and female Olympians had enjoyed academic competitions and the Olympiad experience. However, the males had taken part in more competitions than the females had. The males had had more peer support at school and hobbies that had supported their talent development more than the females had. However, the female Olympians reported more often teachers' encouragement as an influential event than their male counterparts.

The most successful Olympians had studied abroad during their graduate studies. Both males and females mentioned the choice of the right domain as an influential factor for their academic success. The Finnish Olympians had been very independent students and only three of them reported mentoring as a critical event in their talent development. Those females who had found a good mentor had continued their graduate studies and chosen an academic career.

International co-operation was identified as the most influential factor for academic success. The most well known researchers in our sample had used international co-operation in their work and published in international journals. Both males and females identified a choice of a supportive partner as a critical event. The females who referred to their husbands, reported equal responsibilities with child-care and opportunities for both spouses to actualize their talents. The male perspective emphasized the freedom to concentrate on the academic work because of the wife who takes care of the household. Two

of the males reported positive events in mentoring the future Olympians as influential for their talent actualization.

Our study suggests that parents should actively and early enough encourage their daughters to science experiments and mathematical problem solving. Furthermore, the girls should be guided to intellectual hobbies that support their talent development during their school years. The teachers should acknowledge their important role in encouraging the girls to choose mathematics and science in their studies. Furthermore, the girls need help in finding the peer support at school for their talent development. The educators and mentors should guide the gifted females to choose the right domain and encourage them to study abroad. According to our results, the most successful scientists in academia need international co-operation to gain eminence in their fields. Furthermore, the importance of partner choice in the lives of gifted scientists should be addressed and discussed with gifted girls. The life histories and critical events experienced by gifted people can guide our efforts in providing equal opportunities for both females and males to actualize their talents.

References

Ajzenberg-Selove, F. (1994). A matter of choices: Memoirs of a female physicist. Brunswick, NJ: Rutgers University Press.

Arnold, K. (1995). Lives of promise: what becomes of high school valedictorians: a fourteen-year study of achievement and life choices. San Francisco: Jossey-Bass Publishers.

Bizzari, J. (1998). An intergenerational study of three gifted women: obstacles and challenges confronting women of high potential. Roeper Review, 21(2), 110-116.

Campbell, J. 1996. Early identification of mathematics talent has long-term positive consequences for career contributions. International Journal of Educational Research Vol. 26, 6, 497-522.

Coffey, A., & Atkinson, Paul. (1996). Making sense of qualitative data. Thousand Oaks, CA: Sage.

Denzin, N. (1989). Interpretive biography. Newbury Park, CA: Sage Publications.

Flanagan, J. (1953). The critical incident method. Pittsburgh, PA: American Institute for Research and University of Pittsburgh.

Gardner, H. (1993). Frames of mind. (2 ed.). New York: BasicBooks.

Hansen, J. B., & Hall, E. G. (1997). Gifted women and marriage. Gifted Child Quarterly, 41 (4), 169-180.

Harrington, C., & Boardman, S. (1997). Path to success. Cambridge, MA: Harvard University Press.

Harris, C. R. (1992). The fruits of early intervention: The Hollingworth group today. Advanced Development, 4, 91-104.

Holahan, C. (1984). The relationship between life goals at thirty and perceptions of goal attainment and life satisfaction at seventy for gifted men and women. International Journal of Aging and Human Development, 20(1), 21-30.

Hollinger, C. L., & Fleming, E. S. (1992). A longitudinal examination of life choices of gifted and talented young women. Gifted Child Quarterly, 36, 207-212.

Kerr, B. (1994). Smart girls: A new psychology of girls, women and giftedness. (Rev. ed.). Scottsdale, AZ: Gifted Psychology Press.

Kitano, M. (1997). Gifted Asian American women. Journal for the Education of Gifted, 21(1), 3-37.

Leroux, J. (1998). Follow your dream: Gifted women and the cost of success. Gifted Educational International, 13(1), 4-13.

Miles, M., & Huberman, M. (1994). Qualitative data analysis. (2 ed.). Thousand Oaks, CA: Sage.

Moon, S. (2000, May). Personal talent: What is it and how can we study it? Paper presented at the Fifth Biennial Henry B. and Joycelyn Wallace National Research Symposium on Talent Development, Iowa City, IA.

Multon, K.D., Brown, S. D., & Lent, R. W. (1991). Relation of self-efficacy beliefs to academic outcomes: A meta-analytic investigation. Journal of Counseling Psychology, 38, 30-38.

Noble, K., Subotnik, R., & Arnold, K. (1999). A thine own self be true: A new model of female talent development. Gifted Child Quarterly, 43 (3), 140-149.

Piirto, J. (1991). Why are there so few? (Creative women: visual artists, mathematicians, musicians). Roeper Review, 13 (3), 142-147.

Reis, S. (1998). Work left undone. Mansfield Center, CT: Creative Learning Press.

Richardson, L. (1995). Narrative and sociology. In J. Van Maanen (Ed.), Representation in ethnography. (pp. 198- 221). Thousand Oaks, CA: Sage.

Rogers, K. (1991). The lifelong productivity of the female researchers in Terman's genetic studies of genius longitudinal study. Gifted Child Quarterly, 43(3), 150-169.

Rosser, S. (2000). Women, science, and society. New York: Teachers College Press.

Sawyer, R. K., & Csikszentmihalyi, Mihaly. (1994). Social influences on the creative process: An autobiographical memory study of creativity through the lifespan. In N. Colangelo, S. Assouline, & D. Ambroson (Ed.), Talent development: Proceedings from the 1993 Henry B. and Jocelyn Wallace National Research Symposium of Talent Development (Vol. 2, pp. 467-471). Dayton, OH: Ohio Psychology Press.

Siegle, D. & Reis, S. (1998). Gender differences in teacher and student perceptions of gifted students' ability and effort. Gifted Child Quarterly, 42(1), 39-47.

Sternberg, R. J. (1986). A triarchic theory of intellectual giftedness. In R. J. Sternberg & J. E. Davidson (Eds.), Conceptions og giftedness (pp. 233-243). Cambridge, MA: Cambridge University Press.

Tirri, K. (2000a, April). What factors contribute to the development of academic talent in Finland? Paper presented at the Annual Meeting of the American Educational Research Association, New Orleans, LA. EDRS (ED 442735)

Tirri, K. (2000b, August). Actualizing mathematical giftedness in adulthood. Paper presented at the ECHA conference, Debrecen, Turkey. To appear in ERIC Clearinghouse on Disabilities and Gifted Education.

Tirri, K. & Koro-Ljungberg, M. (2001). Critical incidents in the lives of gifted female Finnish scientists. Journal of Secondary Gifted Education (in press).

Tripp, D. (1994). Teachers' lives, critical incidents, and professional practice. International Journal of Qualitative Studies in Education, 7(1), 65-76.

Wager, M. (1994). Constructions of femininity in academic women. Annales Academie Scientiarum Fennica Jyväskylä: Academia Scientiarum Fennica.

White, W. L. (1990). Interviews with Child I, Child J, and Child L. Roeper Review, 12, 222-227.

Women in Academia (1999). Report of the working group appointed by the Academy of Finland. Publications of the Academy of Finland 3/98. Helsinki: Academy of Finland.

Table 1

Description of participants (females are presented in boldface)

Name	Age	Marital status	Field	Highest degree	Current position	Publications (1998)	Patents
Sirpa	26	Single	Medicine	M.D.	Medical doctor	0	0
Vuokko	29	Single	Physics	M.S.	Research Engineer	0	0
Riitta	53	Married, 4 children	Mathematics	M.S.	Secondary School Teacher	5	0
Hanna	36	Married, 2 children	Physics	Ph.D.	Researcher	28	0
Kaisa	52	Married, 3 children	Mathematics	Ph.D.	Researcher	33	2
Elina	32	Single	Physics	M.S.	Researcher	22	0
Matti	54	Divorced, 2 children	Mathematics	Ph.D.	Lecturer	57	0
Timo	53	Married, 3 children	Mathematics	Ph.D.	Professor	20	0
Jyrki	36	Single	Computer science	Ph.D.	Researcher	21	0

			science				
Patric	36	Engaged, 1 child	Computer science	Ph.D.	Professor	58	2
Jari	29	Married, 1 child	Mathematics	M.S.	Analyst	0	0
Heikki	36	Single	Mathematics	Ph.D	CEO	7	4

Table 2

Critical events in the lives of Finnish Olympians

Critical events	Males (N=6)	Females (N=6)
Events in childhood	**18**	**6**
Reading experiences	6	2
Mathematics experiences	6	2
Science experiments	3	1
Discussions with parents	3	1
Events in school	**18**	**15**
Academic competitions	6	6
Teachers' encouragement	3	5
Peer support	4	2
Hobbies	5	2
Events in college	**7**	**6**
Studies abroad	3	2
Choosing the right domain	3	2
Mentor's support	1	2
Events in adulthood	**8**	**4**
International co-operation	3	2
Mentoring the youth	2	0
Partner choice	3	2